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## ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

## Endomycorrhizae Enhance Survival and Growth of Fourwing Saltbush on Coal Mine Spoils<sup>1</sup>

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Fourwing saltbush (*Atriplex canescens*) is a valuable shrub that provides forage for domestic livestock, food and cover for wildlife, and protects soil from wind and water erosion in semiarid areas. These features are beneficial for coal mine spoil reclamation efforts in areas receiving less than 250 mm of precipitation. Inoculation of saltbush seedlings with *Glomus mosseae* improves transplanting success.

**Keywords:** Inoculation, endomycorrhizae, coal mine spoils, *Atriplex canescens*, *Glomus mosseae*.

Recent work shows that growth of fourwing saltbush is enhanced under greenhouse conditions by the presence of vesicular-arbuscular (VA) endomycorrhizae (Williams et al. 1974). Endomycorrhizae are present on 13 other common shrubs found in the semiarid Southwest (Williams and Aldon 1975); identity of these mycorrhizae is under investigation. VA mycorrhizae on other plant species reduce internal plant resistance to water flow and water uptake (Safir et al. 1972), and assist in the uptake of phosphates (Daft and Nicolson 1969). The value of these attributes to plants growing in a semiarid environment is obvious, but heretofore untested. The purpose of this test, therefore, was to determine whether or not endomycorrhizae would improve survival and growth of fourwing saltbush, an important revegetation species in the Southwest, on coal mine spoils.

<sup>1</sup>The research reported here is a contribution to the SEAM program. SEAM, an acronym for Surface Environment and Mining, is a USDA Forest Service program to research, develop, and apply technology that will help maintain a quality environment and other surface values while helping meet the Nation's mineral requirements. This work was conducted in cooperation with Pittsburg and Midway Coal Company. We appreciate the assistance we received.

<sup>2</sup>Principal Hydrologist, Rocky Mountain Forest and Range Experiment Station, located at the Station's Research Work Unit at Albuquerque, in cooperation with University of New Mexico; Station's central headquarters is maintained at Fort Collins, in cooperation with Colorado State University.

In this study, fourwing saltbush plants were grown from seed in small 4.75 x 6.35 cm asphalt plant bands by special techniques (Aldon 1970c). All bands were filled to 1.9 cm of the top with soil having a particle size less than 4.18 mm. The sandy loam soil was from an alluvial site, with a pH of 7.5 and a saturated conductivity of 0.67 mmho/cm. A 1.75 gram sample of soil infested with *Glomus mosseae* Nicol. and Gerd.,<sup>3</sup> a phycomycete reported to form endomycorrhizae on many species of plants, was added to one-half of the plant bands. The control soil was not treated.

Five dewinged fourwing saltbush seeds were planted in each band and covered with additional soil up to 0.5 cm from the top. They were grown outdoors and irrigated with municipal water. Plants were thinned to 1 plant per band, and overwintered in a lathhouse.

Twenty-one replications of each treatment (mycorrhizal and control) then were planted in the field by tested methods (Aldon 1970a) on coal mine spoils of the McKinley coal mine, 32 kilometers northwest of Gallup, New Mexico. The site is at an elevation of 2100 meters in the pinyon-juniper-sagebrush vegetation type. The spoils material resulted from mining completed in 1969.

<sup>3</sup>Inoculum furnished by D. H. Marx, Principal Plant Pathologist, Southeastern Forest Experiment Station, USDA Forest Service, Athens, Georgia.

This site received 190 mm of precipitation during the study year, about half the normal amount. Some flooding occurred late in the second growing season, and the plants were under water for 30 hours. Inundation of this plant decreases survival markedly (Aldon 1970b). Sediment deposits covered many plants, leaving only half of the plants available for growth determinations. Survival was measured in July of the first growing season, and height and diameter of plants and root infection were measured after the second growing season. Root samples were taken at random from four treated plants and from three controls. Roots were cleared, stained, and examined for presence of endomycorrhizae (Williams et al. 1974). Controls were found to be nonmycorrhizal, but all treated samples had abundant intracellular and intercellular mycelia.

Average survival and growth were significantly better on plants grown in soil infested with *G. mosseae*:

	Mycorrhizal	Control
Height (cm)	41.7	27.4
Diameter (cm)	35.8	21.3
Size index (height times diameter)	1493	584
Survival (percent)	95	84

These results suggest that fourwing saltbush should be mycorrhizal prior to field planting. The findings are of special significance to those engaged in rehabilitation of mine spoils. Inoculation with *G. mosseae* could improve plant survival and growth on these sites.

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